



SECTION F

TECHNICAL AND PERFORMANCE SPECIFICATIONS

GLEN HELEN LIGHTING PROJECT

FOR

SAN BERNARDINO, CALIFORNIA

PROJECT NO.: 30.30.0146

01 - GENERAL REQUIREMENTS

01. MOBILIZATION

Mobilization shall consist of preparatory work and operations, including, but not limited to, those necessary for the movement of personnel, equipment, supplies and incidentals to the project site; for the establishment of all offices, buildings and other facilities necessary for work on the project; and for all other work and operations which must be performed or costs incurred prior to beginning work on the various contract items on the project site.

Mobilization shall conform to the provisions in section 9-1.16D, "Mobilization," of the 2015 Caltrans Standard Specifications.

The contract lump sum price paid for **Mobilization** shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in mobilization as specified herein. No additional compensation will be allowed for additional mobilization/demobilization costs due to weather days or loss of production due to cold weather.

Payment will be made on a basis of the percentage of work completed on the entire project.

02. PROJECT GEOTECHNICAL ENGINEERING INVESTIGATION

A "Geotechnical Investigation Report, Glen Helen Regional Park Lighting Project," prepared by Leighton Consultants, dated August 11, 2023, is included in Section H.

No warranty, either expressed or implied, is made as to the information contained in the report, dated August 11, 2023, by Leighton Consultants and the boring logs contained therein. This report is provided for information only. It is the responsibility of each bidder to perform his own investigation and verification of the site conditions prior to bidding on the project. The submission of a bid shall be conclusive evidence that the Contractor has investigated and is satisfied as to the general and local conditions to be encountered.

03. DUST CONTROL AND WATER SUPPLY

This work, Dust Control, shall consist of all operations necessary to control fugitive dust arising from construction operations, and due to any disturbance of natural ground covers resulting therefrom, in compliance with governing EPA and NPDES requirements and shall conform to the provisions in Section 10-5, "Dust Control," of the 2015 Caltrans Standard Specifications and these Specifications.

The Contractor is responsible for meeting and being in compliance with all of the requirements of the South Coast Air Quality Management District's (AQMD) "Rule 403, Fugitive Dust." Information on AQMD and "Rule 403, Fugitive Dust" can be found at <http://www.aqmd.gov>. Should the County be fined due to failure of the contractor to comply with Rule 403 requirements, the amount of any such fines will be withheld from payments due or to become due to the Contractor.

The compensation paid for Dust Control shall include, but not be limited to compensation for maintaining dust control and air contaminants within the project area. Watering site as needed to control dust during project duration, street sweeping as needed to control dust and maintain clean public roadways, and application of chemical dust stabilizers shall be included in the prices paid for **various contract items** of work and no additional compensation will be allowed therefor.

04. CLEARING AND GRUBBING

Clearing and grubbing shall conform to the provisions in Section 17-2, "Clearing and Grubbing," of the 2015 Caltrans Standard Specifications and these Specifications.

This work, shall include, but not be limited to, trimming, clearing, and grubbing of vegetation within the excavation areas or as directed by the County.

The Contractor shall be required to adequately and completely remove any and all existing improvements within the limits of the Work, as necessary to construct the required improvements.

It shall be the Contractor's responsibility to protect all existing improvements not designated for removal. The Contractor shall be responsible for any and all damage that was done to existing property and adjacent properties during all construction work under this contract, and the Contractor, at its expense, shall make any repairs that result from its operations to the approval of the County and the subject property owner.

Nothing herein shall be construed as relieving the Contractor of his responsibility for final cleanup of the work site as provided in Section 4-1.13, "Cleanup," of the 2015 Caltrans Standard Specifications.

The compensation paid for Clearing and Grubbing shall include, but not be limited to compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in clearing and grubbing as specified herein shall be included in the prices paid for **various contract items** of work and no additional compensation will be allowed therefor.

05. DIVERSION, DEWATERING, AND CONTROL OF WATER

This work shall consist of devising, installing, maintaining and removing measures necessary to protect the project against the intrusion of water, including but not limited to, storm water, ground water, mud, and any flows carrying deleterious matter, as well as protection of public and private property. Such work shall be in accordance with provisions in Section 13, "Water Pollution Control" of the 2015 Caltrans Standard Specifications and these Specifications.

It is anticipated that storm, surface, ground or other waters will be encountered at various times and locations during excavation and construction. Increased risk of storm runoff shall be anticipated during any period between October 15th and April 15th of the following year. Such waters may interfere with the Contractor's operations and may cause damage to adjacent or downstream private and/or public property by flooding or erosion if not properly controlled. In submitting a bid, the Contractor acknowledges such risks and assumes all responsibility therefore,

except as otherwise provided in Section 5-1.39, "Damage Repair and Restoration" of the 2015 Caltrans Standard Specifications and in these Specifications.

There shall be a scheme of operations and all methods proposed for dewatering and/or protection against potential damage to the work within the project limits. Said plan will be the basis for inspection of protective measures by the Engineer, or his authorized representative, and shall be amended by, or under the direction of, the Professional Engineer who originally prepared the plans to reflect actual construction practices or changes of conditions at the work site(s). Except as otherwise allowed in this section, the Contractor shall bear full responsibility for the adequacy and effectiveness of protective measures.

It shall be the responsibility of the Contractor to dewater any groundwater encountered during construction. The Contractor's method of dewatering shall be submitted to the Engineer for approval prior to commencing work. The Dewatering Plans shall be prepared, designed and stamped by a California Registered Professional Engineer or Civil Engineer duly approved by the County prior to commencing the work showing the scheme of operations. Such submittal of plans does not relieve the Contractor of the Contractor's responsibility to protect the work from damage per Section 5-1.37 "Maintenance and Protection" of the 2015 Caltrans Standard Specifications. Approval of the dewatering method by the Engineer shall in no way transfer responsibility or liability for dewatering to the Engineer, and/or County.

The Contractor, after initial dewatering, shall continue to take protective measures to protect the project area from all storm flows, existing surface flows, groundwater, mud, and other deleterious matter. Dewatering facilities shall be maintained until construction in which groundwater is encountered is completed.

Full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work necessary to devising, installing, maintaining and removing measures necessary to protect the project against the intrusion of water, including but not limited to, storm water, ground water, mud, and other deleterious matter, and for extra work costs for clean-up, repair, restoration, or replacement of damaged work shall be included in the prices paid for **various contract items** of work and no additional compensation will be allowed therefor.

06. TRENCH/EXCAVATION SAFETY

This work, Trench/Excavation Safety, shall consist of furnishing, implementing, maintaining and removing protective measures for excavation(s) in excess of five feet, that adequately provide protection from hazards of caving ground, conforming to the provisions in 7- 1.02K(6)(b), "Excavation Safety," of the 2015 Caltrans Standard Specifications; Section 6707 of the Labor Code; Section 832 of the Civil Code; Article 6, Subchapter 4, Chapter 4, Title 8 of the California Code Regulations {Construction Safety Orders}; and these Specifications.

Unless otherwise certified in writing by a registered civil or structural engineer, all soil type, except bedrock, for the purposes of designing trench/excavation safety measures shall be considered to be Type C. Contractor shall be solely responsible for damages resulting from its

failure to prevent collapse or failure of excavations under all load conditions encountered during construction.

The stability of temporary excavations is a function of several factors, including the total time the excavation is exposed, moisture condition, soil type and consistency, and contractor's operations. The Contractor is responsible for excavation safety. As a guideline, temporary construction excavations greater than 3 feet but less 10 feet deep should be planned with slopes no steeper than 1.5H: 1V (Horizontal to Vertical). For steeper temporary construction slopes or deeper excavations, the Contractor shall submit a shoring plan designed and stamped by a California licensed Professional Civil or Structural Engineer.

Contractor's attention is directed to Section 4-1.05, "Changes and Extra Work", of the 2015 Caltrans Standard Specifications. Provisions in this section pertaining to "Increases" shall not apply to increases in trench/excavation safety measures due to changes in the types of soil or other conditions upon which are based designs of such measures, except as provided in Section 4- 1.05B, "Work-Character Changes."

Unless otherwise specified, Contractor shall obtain, at no additional cost to the County, such licenses, permits, or approvals as may be required from adjacent property owners, and/or owners of easement rights overlying Contractor's work site(s), relating to trench/excavation safety and protection of said owner's property, equipment, or existing facilities from damage arising from caving ground in vicinity of Contractor's excavation(s).

Requirements in Section 7-1.02K(6) "Occupational Safety and Health Standards", of the 2015 Caltrans Standard Specifications to submit a Trench Excavation Safety Plan 5 days (or 3 weeks for an engineered plan) before the Contractor intends to begin excavation shall be considered to be amended to comply with any conditions for necessary permits, licenses, or approvals that exceed said requirements, at no additional cost to the County.

Entities from which licenses, permits, or approvals shall be obtained for this project are:

State Department of Industrial Relations, Division of Occupational Safety [Project specific or annual excavation permit]

Reflectors shall be affixed to shoring on all sides facing traffic.

Open trenches or holes will be inspected by County Inspector prior to backfilling.

Payment for Trench/Excavation Safety shall be included in **various contract items** and shall be full compensation for furnishing all labor, materials, tools, equipment and incidentals, required to do all the work, including, but not limited to, investigating soil and other conditions, designing, providing, installing and maintaining adequate sheet piling, shoring, bracing, lagging, cribbing, piling, shielding, benching and sloping, to maintain safe working conditions in and around any otherwise unsupported excavation five feet or greater in depth, necessary for workers protection in the course of constructing the work in accordance with the plans, 2015 Caltrans Standard

Specifications, and these Special Provisions, and in accordance with the Contractor's selected methods of construction. No other compensation will be allowed therefor.

07. DEMOLITION AND REMOVAL OF EXISTING STRUCTURES

This work shall consist of demolition, removal, and disposal of existing light poles, backfilling of cavities created, site restoration, and cofferdams and shoring (if required) in accordance with Section 19-3 of the 2015 Caltrans Standard Specifications and these Specifications.

The Contractor shall be fully responsible for ensuring safety in areas underlying and adjacent to the construction site. The Contractor will be responsible for any loss or damage caused as a result of his actions. The Contractor shall prevent movement, settlement or damage to adjacent structures, grades or portions of existing structures to remain. If the safety of the structure being removed, or adjacent structures or grades appear to be in danger, the Contractor shall cease operations and notify the County immediately.

Attention is directed to the provisions in Section 17-2, "Clearing and Grubbing," and 19-1.03D, "Buried Manmade Objects", of the 2015 Caltrans Standard Specifications and these Specifications.

Blasting will not be allowed for demolition. The existing structure shall be demolished to an elevation 36 inches below the bottom of the existing footing.

Reinforced concrete superstructure, substructure and/or culvert components, including piles, if applicable, shall be demolished to the limits described in these Specifications.

Precast components shall be dismantled and removed in a similar manner and sequence as the original installation procedure. Demolition of precast concrete components, particularly prestressed components will not be allowed until the precast component has been transported to an approved demolition site. Specific requirements for relaxing the force in the prestressing strands and cutting and removing post tensioning cables (if applicable) shall be included in the demolition procedure.

Structural steel components, including bearings and bolts, shall be demolished, removed, and disposed of in accordance with the 2015 Caltrans Standard Specifications and these Specifications.

Any debris that falls off the structures onto the underlying ground shall be immediately cleaned up by the Contractor.

The Contractor shall backfill all cavities created by the demolition operations with suitable material approved by the County and in accordance with the Specifications.

The Contractor shall restore the site in whole or in part, shall not be reused in any other lighting system or structure in the future, and shall be disposed of off-site in accordance with the provisions in Section 5-1.20B(4) "Contractor Property Agreement," Section 14-10" Solid Waste Disposal

and Recycling,” and Section 14-11,” Hazardous Waste and Contamination,” of the 2015 Caltrans Standard Specifications.

The contract lump sum price paid for **“Demolish and dispose of existing light poles”** shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals and for doing all the work involved in demolition, removal, and disposal of the existing light poles, including but not limited to footings, backfilling of cavities created, site restoration, and cofferdams and shoring (if required) in accordance with Section 19-3 of the 2015 Caltrans Standard Specifications and these Specifications.

08. EARTHWORK

Earthwork shall conform to the provisions in Section 19, “Earthwork,” of the 2015 Caltrans Standard Specifications and these Specifications.

Any work done to obtain the compaction requirements for the area or the areas below the grading plane, per Section 19-5.03B “Relative Compaction (95 percent),” of the 2015 Caltrans Standard Specifications, shall be the responsibility of the Contractor, and payment for such shall be considered as included in the lump sum price paid for **“Install- lighting poles, solar lighting system and concrete bases ”** and no additional compensation will be allowed therefore.

Excavation and backfill shall conform to the provisions in Section 19-3, “Structure Excavation and Backfill”, of the Standard Specifications and these Specifications.

Excavations for temporary cuts (over-excavation) to accommodate light pole base footings, shall be made in accordance with the plans and per the Geotechnical Report.

The material used for the structure backfill shall be per the Geotechnical Report recommendations and structure backfill shall be placed per section 19-3 of the 2015 Caltrans Standard Specifications.

Backfill material shall be placed in uniform layers and shall be brought up uniformly on all sides of the structures. The gradation and distribution of materials through the compacted backfill shall be such that the backfill is free from lenses, pockets, streaks, and layers of material differing substantially in texture or gradation from surrounding materials. The thickness of each layer of backfill shall not exceed eight inches (8”) in height before compaction. Compaction of the structure backfill shall be accomplished by hand-operated or heavy construction equipment, depending on the area to be filled. The Engineer, or his authorized representative shall determine which method shall be used. Heavy construction equipment shall not be operated within five feet (5’) of concrete walls.

Structure backfill shall be moisture conditioned to between its optimum moisture content and two percent (2%) above its optimum moisture content and compacted to a dry density of not less than ninety-five percent (95%) of its maximum laboratory dry density as measured by California Test CT-231 (Nuclear Gauge). Structure backfill shall not be placed until the structure has been inspected by the Engineer or his authorized representative and approved for backfilling. No

backfill material shall be deposited against the concrete until the concrete has developed strength not less than required by these plans and Specifications.

Concrete base footing excavation shall be at least 3-5 feet below the footing elevation, and 4 feet laterally from the outside line of the footing, in accordance with the geotechnical report.

Backfill shall be in accordance with the manufacturer's or supplier's recommendations but shall not be less than the following: 3–5-foot depth under the footings, 4 feet at footing sides.

Full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all the work involved in light pole base earthwork, including excavation and over excavation, structure fill (95% compaction), and backfill (90% compaction), as shown on the plans and specified in these Special Provisions, shall be considered as included in the lump sum price paid for **“Install- lighting poles, solar lighting system and concrete bases ”** and no additional compensation will be allowed therefor.

NOT FOR BIDDING

SOLAR POWERED OUTDOOR LIGHTS

SCOPE OF WORK

The work shall consist of furnishing and installing solar powered outdoor lighting in accordance with these Specifications, which shall be regarded as minimum standards for design and construction.

The solar powered outdoor lighting will include the following details:

1. Pole Height: As required by design to meet the AASHTO 2018 lighting requirements for Interior Roadways and Parking Areas.
2. Finish: Black Powder Coat
3. LED Color Temperature: 4000K

QUALIFIED SUPPLIERS

Each bidder is required to identify the intended solar powered light supplier as part of the bid submittal. Qualified solar powered light suppliers must have at least ten (10) years' experience designing and fabricating these type structures, and a minimum of ten (10) successful solar powered outdoor lighting projects, of similar construction, each of which has been in service at least three (3) years.

Qualified solar powered lighting suppliers:

Fonroche Lighting America, Forest Hill, TX
Contact: Sales@Fonroche.US | 339-225-4530

First Light Technologies Ltd., 3303B Tennyson Ave, Victoria, British Columbia, V8Z 3P5
Phone: +1 844-279-8754

The contractor must provide the following documentation, for any proposed supplier who is not pre-approved, at least 10 days prior to bid:

- Product Literature: Specification Sheet
- All documentation to ensure the proposed substitution will be in compliance with these specifications. This shall include:
 - Photometric design plan and drawings on surface from a defined lamp height compliant with IES LM-79. Winter light level should be noted within the files and/or reflected in the lighting plots.
 - Pole Foundation Engineered Design Stamped by California Registered Engineer.
 - Luminaire Schedule confirming efficacy values.
 - Calculation of Effective Projected Area (EPA) and weight of the solar lighting system, and EPA rating of the pole (if provided).

- Cost Estimate with Lead Time of Delivery
- Warranty information for poles and batteries, including expected life of batteries.
- Wiring Diagram Design Stamped by California Registered Engineer.
- References of at least 10 installation sites for the submitted supplier.
- Installation Instructions.
- Passed testing results.
- System Calculations for Photovoltaic Array Sizing, Luminaire Load and Depth Discharge.

The County will evaluate and verify the accuracy of the submittal prior to bid. If the County determines that the qualifying criteria have not been met, the contractor's proposed supplier shall be rejected. The County's ruling shall be final.

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solar Powered Outdoor Lighting

1.2 REFERENCES

A. American National Standards Institute / Institute of Electrical and Electronic Engineers (ANSI/IEEE)

1. ANSI/ESD S20.20-2007 Development of an Electrostatic Discharge Control Program
2. ANSI C136.31-2018, American National Standard for Roadway Luminaire Vibration specifications for Bridge/overpass applications

B. International Electrotechnical Commission

1. IEC 61730-1:2019
2. IEC 61215-2:2017

C. International Organization for Standardization (ISO)

1. 9001-2015 – Quality Management Systems

D. Underwriters Laboratories

1. UL 1703
2. UL 2054

E. European Standards

1. CE

F. IDA, International Dark Sky Association (www.darksky.org)

1.3 DESCRIPTION - DEFINITIONS

- A. **“System Location”** is the exact location of the system installation. The geographic coordinates are used to determine anticipated Solar Insolation.
- B. **“Solar Insolation”** is the amount of solar radiation available at the geographic location. Properly designed systems will use the lowest minimum monthly average (typically December in the Northern Hemisphere) when calculating the Array size.
- C. **“Photovoltaic or PV”** a method of converting solar radiation energy into direct current electricity.

- D. **“Lighting Profile”** is the way in which the LED Luminaire is powered throughout the night accumulating to give the total energy used by the system. This is sometimes referred to as the dimming profile as luminaires can be set to dim the light output for a portion of the night to reduce the total energy load of the system.
- E. **“Photovoltaic Panel Tilt Angle”** – The angle relative to horizontal, to which the PV panel is tilted while pointing towards the equator. Tilt angle influences the amount of energy that can be collected at a given location at specific time of year.
- F. **“LED Luminaire”** is a complete lighting fixture housing solid state lights, lens optics, and heat sink.
- G. **“Luminaire Wattage”** is the energy used by the luminaire to produce light. Used in the calculation of the system load.
- H. **“Light Distribution”** are general IES classification for different types of optics used to project the light emitted from the LED. Each type projects the light in different ways which allows designers to optimize the light uniformity for a given area.
- I. **“Light uniformity”** is how well the light from multiple luminaires is distributed over a given photometric study area. Typically, a ratio of the (maximum or average) amount of the light projected on the area and the minimum light value calculated within the area.
- J. **“IES LM 79”** – is a standardized test which measures total luminous flux, luminous intensity distribution, electrical power, efficacy (lumens per watt delivered), and color characteristics (chromaticity, CCT, and CRI) of the complete luminaire. This test must be done by an accredited independent laboratory.
- K. **“Color Temperature”** – measured in Kelvin, denotes how warm or cool the color produced by the luminaire is. Typically, 3000K-4000K.
- L. **“Batteries”** – how the energy produced by the PV array is stored for nighttime use to power the luminaire load.
- M. **“SOC”** is level of *charge* of an electric battery relative to its capacity.
- N. **“Anti-Blackout”** – Load management based on battery state of charge.

1.4 QUALITY ASSURANCE

- A. Manufacturer: Minimum 10 years of experience in manufacture of solar powered lighting systems.

1.5 SAFETY COMPLIANCE

- A. Photovoltaic Panel is a Nationally Recognized Testing Laboratory listed per UL/CSA 1703 or IEC 61730-1:2019 & IEC 61215-2:2017.
- B. Luminaire approved by a Nationally Recognized Testing Laboratory.

1.6 PROJECT CONDITIONS

- A. Ambient temperature: -40° to 70° C. (-40°F to 156°F)
- B. Pole and all coupling components exceed maximum specified EPA ratings required for local wind loading conditions.
- C. Pole foundations will be designed or stamped approved by a Registered Professional Engineer to ensure local building codes are followed. The Licensed Professional Engineer will be employed by the Contractor and shall be a registered engineer in the State of California

1.7 PERFORMANCE AND SOLAR CALCULATIONS

A. Sizing Criteria and Project Requirements for San Bernardino CA:

1. Sun Hours (Insolation) based on global coordinates: 3.35 kWh/m² per day.
2. Longest Night: 14.08 hours
3. Latitude: 34.10° North / Longitude: -117.29° East
4. Parking Lots Single: Must be able to demonstrate through solar study, energy calculations, and system sizing the ability to achieve a minimum of 37 watts/6660 lumens per fixture all night without dimming for a single-fixture system using a single 310W panel and single 1248 whr battery bank.
5. Parking Lots Double: Must be able to demonstrate through solar study, energy calculations, and system sizing the ability to achieve a minimum of 37 watts/6660 lumens per fixture all night without dimming for a double-fixture system using a double 310W panel and double 1248 whr battery bank.
6. Access Roads Twin: Must be able to demonstrate through solar study, energy calculations, and system sizing the ability to achieve a minimum of 18 watts/3240 lumens per fixture all night without dimming for a double-fixture system using a single 310W panel and single 1248 whr battery bank.
7. Access Roads Single: Must be able to demonstrate through solar study, energy calculations, and system sizing the ability to achieve a minimum of 28 watts/5040 lumens per fixture all night without dimming for a single-fixture system using a single 270W panel and single 936 whr battery bank.
8. Luminaire Temperature: Must have luminaire CCT option of 4000K.
9. LED driver must be integrated with the solar charge controller as one unit.

B. Manufacturer shall submit detailed information on how the sizing was calculated including the formula with details on all factors included. Sizing shall demonstrate that the worst-case SOC will support the proposed light level all year long.

C. Manufacturer shall provide a photometric layout meeting the specified standard or the specified light levels and uniformity. Light Loss Factor shall be consistent with specification.

D. Light Levels / Light Loss Factor (LLF) shall be as follows:

- a. Parking Lots: ≥ 1.0 fc average, $\leq 4:1$ Average/Minimum Uniformity Ratio
- b. Access Roads: ≥ 0.6 fc average, $\leq 4:1$ Average/Minimum Uniformity Ratio
- c. LLF: 0.90

E. Photometry must be based on “worst case” calculated light levels in winter – accounting for any anticipated Anti-Blackout or Energy Management adjustments.

1.8 WARRANTY

A. Provide manufacturer’s non-prorated warranty covering 5 years on entire solar lighting system including battery from date of purchase.

1. Local support can be provided by the manufacturer or their trained and authorized representative.

B. The Solar Voltaic Panel covered for minimum 25 years for power output.

1.9 BATTERY STORAGE AND SHIPPING

- A. Batteries hazardous and non-hazardous that are approved for shipping via ground, air, or sea per DOT's Hazardous Materials Regulations (HMR; 49 CFR Parts 171-180).
- B. If storing batteries for future installation: must be stored inside above in a temperature-controlled environment away from sunlight, heat and humidity.
- C. If batteries are stored for longer than 4 months past the date received, may need to be recharged before being installed to ensure battery and system performance.

PART 2 - PRODUCTS

1.10 SYSTEM – General Design

- A. Basis of design product: PV System will be attached at the top of the pole with an integrated or separately mounted battery container.
- B. Proposed Submittals of Light Poles:
 - 1. All proposed material, apparatus, or equipment manufactures of light poles must be submitted in writing for approval by the County within 14 calendar days following the issuance of the Notice to Proceed.
 - 2. Proposed submittals must be accompanied by a review of the specification noting compliance on a line-by-line basis.
 - 3. The Contractor accepts responsibility and associated costs for all required modifications, to circuitry, devices, and wiring necessary to meet the Technical Specifications and Performance Requirements.
 - 4. Contractor must provide complete engineered shop drawings with deviations for the original design highlighted in an alternate color to the County for review and approval prior to installation.
 - 5. Provide battery and photovoltaic calculations as per these specifications.

1.11 GENERAL – Solar Powered Light Systems

- A. Solar Powered Light System consists of six (6) components and assemblies: (1) Photovoltaic (PV) Module(s) (2) Mounting structure, (3) LED Luminaire, (4) Sealed Power Center (5) Weatherproof Wire Harnessing (6) Pole. Luminaire and PV assemblies shall be separate units, allowing for independent orientation of both the lighting and solar panel to achieve optimal performance. The system will at a minimum include the following characteristics.
 - 1. Photovoltaic (PV) Module
 - a. Construction:
 - 1) Crystalline silicon solar cells Rated at Minimum 270W for all Access Road systems and Minimum 310W for all Parking Lot systems.
 - 2) Aluminum Frame
 - 3) UL/CSA 1703 or IEC 61730-1:2019 and IEC 61215-2:2017
 - 4) Sealed behind UV stabilized tempered glass.
 - 5) Black Frame and Backing Sheet for finished appearance.
 - 6) Covered by a 25-year power output warranty.
 - 7) RoHS compliant
 - 8) Cabling will be UV resistant.

- 9) Water-tight wire junction box on PV module
 - 10) The mount assembly shall be galvanized, and powder coated with adjustable tilt from 10 degrees to 45 degrees to optimize system performance and EPA.
- b. Performance:
- 1) PV electrical junction box and connectors (MC4 type) are sealed per IP 67.
 - 2) PV is fastened to support system at a minimum of four locations.
2. LED Luminaire
- a. Construction
- 1) 10-year manufacturer warranty
 - 2) Finish: The Thermosetting resins provide a discoloration resistant finish in accordance with the ASTM D2244 standard, as well as luster retention in keeping with the ASTM D523 standard and humidity proof in accordance with the ASTM D2247 standard. The surface treatment achieves a minimum of 5000 hours for salt spray resistant finish in accordance with testing performed and per ASTM B117 standard.
 - 3) Hardware: All exposed screws shall be complete with Ceramic primer seal to reduce seizing of the parts, also offers a high resistance to corrosion. All seals and sealing devices are made and/or lined with EPDM and/or silicone and/or rubber.
 - 4) Optical System is rated IP66. Performance shall be tested per LM63, LM-79 and TM-15 (IESNA) certifying its photometric performance. 0% uplight and U0 per IESNA TM-15.
 - 5) Bird guard protecting against birds and similar intruders.
 - 6) Internal Shields for Cul-de-sac, Front, Side (right and left) and House side must be available to comply with local requirements and reduce light trespass.
 - 7) Provides an easy step adjustment of +/- 5° tilt in 2.5° increments. Includes integral bubble level standard (always included).
- b. Performance:
- 1) Luminaire efficiency must be ≥ 180 lumens per watt.
 - 2) LED source designed for >60,000 hours performance with over >97.6% initial lumen maintenance.
 - 3) Available in 3000K and 4000K temperatures.
 - 4) Nationally Recognized Test Laboratory listed UL 1598 CSA 22.2.
 - 5) Dark Sky Compliant. (If specified with 3000K)
 - 6) The manufacturer provides relevant .IES files to indicate light dispersion and intensity of LED source.
 - 7) Achieves a maximum BUG rating of [B3], [U0], [G2] in each category at rated operating power. (Where B=Back Light, U=Uplight= Glare)
3. Power Center shall be sealed, pre-loaded with batteries and fully pre-wired.
- a. Construction:

1) Enclosure

- Enclosure shall be IP65 and provide an IP68 screw in valve to safely relieve pressure inside the enclosure. Valve shall be waterproof, oilproof, breathable, UV Resistant with anti-vibration.
- The power center enclosure shall be separate and independent from the solar panel to allow for proper ventilation.
- Enclosure shall be high strength polypropylene with anti-UV treatment.
- The power center shall be connected to the panel and lighting fixture(s) with two, external waterproof connectors.
- Holds from one to four battery packs for a total weight of no more than 50 LBS.

2) Controls

- LED driver must be integrated with the solar charge controller as one unit.
- Charge controller/ LED driver must be capable of controlling and dimming one or two outdoor luminaires.
- The control circuit board shall have a protective conformal coating.
- Over Voltage Protection.
- Internal PV Disconnect.
- Reverse battery polarity protection.
- Self-calibrating load, timing, and charging circuitry.
- Charge Controller operates with temperature compensated limits ensuring battery charging algorithm protects battery (ies) from over and under voltage stress.
 - Charge controller adapts maximum (charged) voltage based on temperature.
 - Charge controller prevents discharge below battery Low Voltage Disconnect (LVD) limit.
 - Battery Management Function to balance cells.
 - Anti-Blackout Protection

3) Battery Minimum Capacity 936 Whrs for all Access Road systems and Minimum Capacity 1248 Whrs for all Parking Lot systems.

- Battery shall be maintenance free Nickel Metal Hydride (NiMH) or Lithium.
- Battery can be rated Hazardous or “Non-Hazardous” by ICAO/IATA/DOT.
- Formulated for charging and operating temperature from -40°C to +70°C.

b. Performance

- 1) Able to perform for duration of at least 3650 cycles.
- 2) Operates in the prescribed Lighting Profile as per the Performance and Solar Calculations found above in 1.9.
- 3) Able to provide all night lighting 365 nights per year.

- c. Wire Harnessing Wire Harnesses Construction
 - 1) All UV stabilized jacketed wiring and connectors.
 - 2) Provided with weather tight enclosures.
 - 3) Provided in variable lengths to eliminate all field wiring.
 - d. Wire Harness Performance:
 - 1) Sealed gasketed connectors prevent dust intrusion.
4. Solar Lighting Pole, PV Structure pole
- a. Construction:
 - 1) Overall Length will be long enough to accommodate luminaire mounting height with enough clearance for the PV panels to be positioned correctly without contacting the mounting arm.
 - 2) Poles and brackets will be constructed out of galvanized powder-coated steel or aluminum which has been engineered to meet AASHTO weight and EPA requirements of the system and applicable building codes at 110 MPH wind speed.
 - 3) Attached to an engineered concrete base.
 - 4) Stainless steel or zinc plated steel hardware for rust-proof and corrosion resistant mounting equipment.
 - 5) Pole meets ANSI C136.36A-2010, for Roadway and Area Lighting Equipment- Aluminum Lighting Poles.
 - b. Pole Performance:
 - 1) Pole Design will meet AASHTO engineering requirements of 110 MPH wind speeds based on the system's weight and EPA.
 - 2) Independently verified pole strength and base details by licensed Professional Engineer and Test Lab.
 - 3) Pole manufacturer must be able to supply a 25' anchor base pole option.
 - c. System Support Structure Performance:
 - 1) The PV support structure and battery cabinet shall mount to a 2.8575" OD X 6" Tenon.
5. Arm
- a. Construction: cast aluminum arm and adapter assembly. Arms will not have any exterior bolts or clamping devices.
 - b. Size: 4'
 - c. Finish: Same as pole
 - d. Mounting: Attachment point on pole will be relative to the final luminaire height as stated in the photometric design.
6. Solar lighting manufacturer must provide two-way LoRa and cellular based wireless central system monitoring and control.
- a. Controls must be based on cellular gateway, and each light point must include on-board LoRa radio.
 - b. Central monitoring and control must contain end user accessible web-based

dashboard.

- 1) Web-based dashboard must include state of battery charge, system connectivity, CO2 reduction, and each light point must be visible on the portal map.

PART 2- EXECUTION

2.1 INSTALLATION

- A. Install equipment in accordance with approved manufacturer's installation instructions.
- B. Install and orient each fixture in accordance with approved manufacturer's specified fixture orientation listed in the Luminaire Location Summary.
- C. Provide complete installation of system in accordance with Contract Documents.

MEASUREMENT AND PAYMENT

The Contractor warrants in his bid that he has contacted various sources and the specified material is available and the price for the material is included in his bid. Full compensation for furnishing and installing Solar Light Poles, assemblies, inspection costs, and furnishing all labor, materials, equipment, tools and incidentals, and for conforming with the requirements of the Specifications, and for doing the work, shall be consider included in the contract lump sum price paid for **“Install- lighting poles, solar lighting system and concrete bases.”** and no additional compensation will be allowed therefor.